

CLAIMS

What is claimed is:

1. An information storage medium, comprising:
multi-streams;
interactive contents comprising information that enables an interface with a user; and
reproduction control information comprising conversion information to convert the multi-streams and/or the interactive contents into digital television (DTV) streams.
2. The information storage medium of claim 1, wherein the multi-streams comprise a moving picture experts group-2 program stream (MPEG-2 PS), an MPEG-4 format stream, an MPEG-7 format stream, and/or a Wavelet transform format stream.
3. The information storage medium of claim 1, wherein the reproduction control information further comprises:
identification information identifying the multi-streams from the interactive contents to perform a DTV stream conversion; and
control information controlling a generation of the DTV streams.
4. The information storage medium of claim 1, wherein the reproduction control information further comprises management information and search information to reproduce the multi-streams and the interactive contents.
5. The information storage medium of claim 4, wherein the reproduction control information further comprises:
information on types of the multi-streams and the interactive contents;
time information to synchronously reproduce and synchronously convert the multi-streams and the interactive contents;
time information to independently reproduce and independently convert the multi-streams and the interactive contents;
parental ranking information on the multi-streams and the interactive contents;
additional information on start times, reproduction periods, and titles of the multi-streams and the interactive contents; and
information of detailed descriptions of the multi-streams and the interactive contents.

6. A method of reproducing data recorded on an information storage medium of a DTV, the method comprising:
- reading out multi-streams, interactive contents, and reproduction control information from the information storage medium having conversion information to convert the multi-streams and/or the interactive contents into DTV streams;
 - converting the read-out multi-streams into transport streams appropriate to the DTV;
 - converting the read-out interactive contents into DTV interactive contents; and
 - multiplexing the transport streams and the DTV interactive contents based on the read-out reproduction control information to generate DTV streams.
7. The method of claim 6, wherein the multi-streams comprise an MPEG-2 PS, an MPEG-4 format stream, an MPEG-7 format stream, and/or a Wavelet transform format stream.
8. The method of claim 7, wherein the MPEG-2 PS is converted into an MPEG-2 TS during the conversion of the transport streams.
9. The method of claim 8, wherein converting the transport streams comprises:
- parsing a pack and a packetized elementary stream (PES) of read-out PS data to extract a video elementary stream (ES) and an audio ES, to extract a system clock reference (SCR) from the pack and to extract presentation time stamp/decoding time stamp (PTS/DTS) from a PES header;
 - assigning the PES header to the video ES and the audio ES;
 - inserting a proper time stamp based on the PTS/DTS;
 - setting an internal timer to be an SCR value of an initial pack;
 - generating a time control signal by determining a time alignment based on the SCR value of a sequential pack;
 - sampling a program clock reference (PCR) obtained using the SCR to generate a program specific information (PSI) packet period signal and a PCR insertion period signal;
 - generating AV packets using a result of inserting the time stamp according to the PCR insertion period signal, and generating program association table (PAT) packets, program map table (PMT) packets, and Null packets;

scheduling the AV packets, the PAT packets, the PMT packets, and the Null packets, while a time control of the AV packets is determined based on the time control signal, and the PAT packets and the PMT packets are alternately scheduled whenever the PSI packet period signals are generated; and

multiplexing the AV packets, the PAT packets, the PMT packets, and the Null packets to generate the MPEG-2 TS.

10. The method of claim 6, wherein converting the DTV interactive contents comprises:

checking a validation of the interactive contents comprising a source document, which is recorded on the information storage medium; and

when the source document is validated, converting comments, process indicators, document type declarations, start tags, end tags, named character references, numeric character references, marked sections, and parsed character data in the source document into a DTV document format to generate a target document comprising the DTV interactive contents.

11. The method of claim 9, wherein generating the DTV streams comprises:

converting the transport streams and the DTV interactive contents into a digital storage media command and control (DSM-CC) standard to generate a DSM-CC message;

forming program and system information protocol (PSIP) information by using information related to a DTV stream conversion in the reproduction control information, and PAT and PMT information;

converting the PSIP information into a PSIP private section; and

multiplexing the PSIP private section and the DSM-CC message with the MPEG-2 TS to generate the DTV streams.

12. An optical recording/reproducing apparatus to reproduce data recorded on an information recording medium on a DTV, the apparatus comprising:

a read-out unit reading out multi-streams, interactive contents, and reproduction control information from the information storage medium having conversion information to convert the multi-streams and/or the interactive contents into DTV streams;

a first transcoder converting the multi-streams read-out by the read-out unit into transport streams appropriate to the DTV;

a second transcoder converting the interactive contents read out by the read-out unit into DTV interactive contents; and

a generator multiplexing the transport streams and the DTV interactive contents and generating DTV streams according to the reproduction control information read out by the read-out unit.

13. The apparatus of claim 12, further comprising:

a digital interface interfacing the DTV streams generated by the generator to transfer to the DTV.

14. The apparatus of claim 12, wherein the multi-streams comprise an MPEG-2 PS, an MPEG-4 format stream, an MPEG-7 stream, and/or a Wavelet transform format stream.

15. The apparatus of claim 14, wherein the first transcoder converts the MPEG-2 PS into an MPEG-2 TS.

16. The apparatus of claim 15, wherein the first transcoder comprises:

a PS parse and demultiplex unit parsing a pack and a PES in PS data read out by the read-out unit to extract a video ES and an audio ES, an SCR from the pack, and PTS/DTS from a PES header;

a video rearranger searching a sequence start code and a picture start code in the video ES output from the PS parse and demultiplex unit to generate a first recognition signal by access unit and to extract the PTS/DTS;

an audio rearranger obtaining a frame size according to audio synchronization information in the audio ES output from the PS parse and demultiplex unit to generate a second recognition signal by access unit and to extract the PTS;

a PES packetizer assigning the PES header to the outputs of the video rearranger and the audio rearranger according to the first and second recognition signals, and inserting time stamps, which are obtained based on the PTS/DTS extracted by the video rearranger;

a time controller determining a time alignment of an AV packet by using an SCR value following the SCR value of an initial pack provided from the PS parse and demultiplex unit to generate a time control signal, and generating a PSI packet period signal and a PCR insertion period signal by sampling the PCR that is obtained using the SCR value;

an AV packet generator generating the AV packets from the output of the PES packetizer according to the PCR insertion period signal;

a PAT packet generator generating PAT packets;

a PMT generator generating PMT packets;

a Null packet generator generating Null packets;

a TS packet scheduler generating a packet selection signal and schedules the AV packets, the PAT packets, the PMT packets, and the Null packets, wherein the time control of the AV packets is determined according to a presence of the time control signal, and the PAT packets and the PMT packets are alternately scheduled when the PSI packet period signals are generated; and

a TS multiplexer multiplexing the AV packets, the PAT packets, the PMT packets, and the Null packets according to the packet selection signal to output the MPEG-2 TS.

17. The apparatus of claim 16, wherein a priority of the TS packet scheduler comprises the AV packets being at a higher priority than the PAT packets and the PMT packets being at a higher priority than the Null packets

18. The apparatus of claim 12, wherein a validation of a source document comprising the interactive contents recorded on the information storage medium, is checked in the second transcoder, and if the source document is validated, comments, process indicators, document type declarations, start tags, end tags, named character references, numeric character references, marked sections, and parsed character data are converted into a DTV document format to generate a target document comprising DTV interactive contents.

19. The apparatus of claim 16, wherein the generator converts the transport streams generated by the first transcoder and the DTV interactive streams generated by the second transcoder into a DSM-CC standard to generate a DSM-CC message, forms PSIP information using information on the DTV stream conversion in the reproduction control information, and the PAT and PMT information generated by the second transcoder, converts the PSIP information into a PSIP private section, and generates the DTV streams by multiplexing the PSIP private section and the DSM-CC message with the MPEG-2 TS output from the TS multiplexer.

20. An apparatus to convert information stored in an information storage medium to DTV streams, comprising:

a read-out unit reading out the information recorded on the information storage medium comprising multi-streams, interactive contents, and navigation information;
a signal processing unit processing the read-out information into reproduction signals;
a first transcoder converting the multi-streams into transport streams;
a second transcoder converting the interactive contents into DTV interactive contents;
a DTV-stream generator generating DTV streams using the transport streams and the DTV interactive contents; and
a navigation engine controlling the DTV-stream generator based on the navigation information.

21. The apparatus of claim 20, further comprising:
a digital interface receiving the DTV streams from the DTV-stream generator and enabling data to be input bi-directionally.
22. The apparatus of claim 20, wherein the digital interface comprises a user-to-user (UU) interface or a user-to-network (UN) interface.
23. The apparatus of claim 20, wherein the multi-streams comprise audio and/or video (AV) stream and subpicture data, where the AV stream has a transport format comprising at least one of moving picture experts group-2 program stream (MPEG-2 PS), MPEG-4, MPEG-7, or a wavelet transform.
24. The apparatus of claim 20, wherein the interactive contents comprises HTML, XHTML, or XML, and joint photographic experts group (JPEG) and portable network graphics (PNG) files.
25. The apparatus of claim 20, wherein the reproduction control information comprises:
reproduction information comprising management information and search information to reproduce the multi-streams and the interactive contents, and conversion information to convert the multi-streams and the interactive contents into DTV streams,
information on a relationship between the multi-streams and the interactive contents in order for the multi-streams and the interactive contents to be converted synchronously and in relation to each other, and

information to distinguish the multi-streams from the interactive contents and control information to control the generation of the DTV streams.

26. The apparatus of claim 20, wherein the navigation information comprises information on types of the multi-streams and the interactive contents, time information to synchronously reproduce and synchronously convert the multi-streams and the interactive contents, time information to independently reproduce and independently convert the multi-streams and the interactive contents, parental ranking information on the multi-streams and the interactive contents, information on a start time, reproduction period, and titles of the multi-streams and the interactive contents, and information on detailed descriptions of the multi-streams and the interactive contents.

27. The apparatus of claim 20, wherein the DTV stream generator converts the DTV interactive contents into data following a digital storage media command and controls a (DSM-CC) standard to generate a DSM-CC message, and forms program and system information protocol (PSIP) information by using the conversion information, and program association table (PAT) information and program map table (PMT) information generated in the first transcoder.

28. The apparatus of claim 27, wherein the PSIP information is converted into a private section and the private section and the DSM-CC message are multiplexed with the transport streams to generate the DTV streams.

29. The apparatus of claim 20, wherein the second transcoder converts the interactive contents into DTV interactive contents by validating a source document in the interactive contents and, if the source document is validated, comments, process indicators, document type declarations, start tags, end tags, named character references, numeric character references, marked sections, and parsed character data (#PCDATA) contents in the source document are converted according to a DTV-HTML format.